

ARTHROTHYNNUS, A NEW GENUS OF ORCHID-POLLINATING THYNNINAE (HYMENOPTERA: TIPHIIDAE).

G. R. BROWN

Museum and Art Gallery of the Northern Territory,
PO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

Arthrothynnus gen. nov. is erected for six new species of Australian orchid-pollinating tephid wasps: *A. angustus* sp. nov., *A. huntianus* sp. nov., *A. latus* sp. nov., *A. nigricrus* sp. nov., *A. queenslandensis* sp. nov. and *A. rufiabdominalis* sp. nov. A key to males is given.

KEYWORDS: Tiphidae, Thynninae, *Arthrochilus*, *Arthrothynnus* gen. nov., *Chiloglottis*, Australia, new genus, new species.

INTRODUCTION

Little has been published on the pollination of Australian orchids by thynnine (Tiphidae: Thynninae) wasps. This literature has been reviewed, from a botanical perspective, by Armstrong (1979) and Adams and Lawson (1993), while Brown and Bower (unpublished manuscript), after examining all available material, record 91 species belonging to at least 19 thynnine genera (including *Arthrothynnus* gen. nov., *Neozeleboria* Rohwer, *Phymatothynnus* Turner, *Thynnoides* Guérin, *Zaspilothynnus* Ashmead, and an undescribed genus) as being attracted to orchids of the genera *Arthrochilus* F. Mueller, *Caladenia* R. Brown, *Chiloglottis* R. Brown, *Diuris* J.E. Smith, *Drakaea* Lindley, *Paracaleana* Blaxell, *Prasophyllum* R. Brown and *Spiculaea* Lindley.

There has been no work published specifically on the taxonomy of orchid-pollinating thynnine wasps. This, and the description of another new genus (Brown 1996), are the first of a several papers dealing with orchid pollinating taxa.

Five of the six species described here were attracted to terrestrial orchids (Orchidaceae: Drakaeinae) of the genera *Chiloglottis* and/or *Arthrochilus* using orchid baiting techniques as discussed by Bower (1992). Such techniques use orchid flowers which are picked and moved (translocated) to another location and used as

bait to attract male tephids. Under such conditions, orchids may attract a number of species, which have been categorised by Bower (unpublished manuscript) as: "pollinator" (those species which have been observed to transfer pollen from one flower to another, thus fertilising it); "potential pollinator" (those sympatric species that show appropriate precopulatory or copulatory behaviour on the labellum of the orchid, and are of a suitable-size to contact the stigma with the mesosoma, but for which pollination has not been observed); and "minor responder" (those species that do not fulfil all of the requirements, whether physical or behavioural, for pollen transfer to occur). Baiting techniques may attract relatively large numbers of wasps.

Arthrothynnus gen. nov. is a genus of small wasps related to *Tmesothynnus* Turner, although it superficially resembles *Neozeleboria*.

Terminology follows Snodgrass (1941), Brown (1989) and Naumann (1991). Punctuation is defined in Brown (1989).

Abbreviations. Morphological characters: T1-7, metasomal tergites 1-7; S1-8, metasomal sternites 1-8. Specimen repositories: AM, Australian Museum, Sydney; ANIC, Australian National Insect Collection, CSIRO, Canberra; BCRI, Biological and Chemical Research Institute, NSW Agriculture, Rydalmere; BMNH, The Natural History Museum, London; MV, Museum of Victoria, Melbourne; NTM, Museum and Art Gallery of the Northern Territory, Dar-

win; QM, Queensland Museum, Brisbane; SAM, South Australian Museum, Adelaide; WPS, W.P. Stoutamire collection, University of Ohio, Akron. Collectors: CCB, C.C. Bower.

SYSTEMATICS

Arthrothynnus gen. nov.

Type species: *Arthrothynnus huntianus* sp. nov.

Diagnosis. Clypeus narrowly truncate, weakly medially raised, not carinate. Antennal prominence above plane of clypeus, slightly medially emarginate. Maxillary palps 6-segmented, basal segment short, segments 2-3 and 5-6 subequal, segment 4 slightly longer. Labial palps 4-segmented, basal segment with dorsal and ventral fringes of setae, as long as segments 2 and 3 combined, 2 and 3 subequal in length, 4 slightly longer than 2 and 3. Pronotum with anterior margin slightly raised, not carinate. Propodeum oblique. Metasoma with segments polished, strongly constricted, and without spines. T7 with broad U-shaped apical carina, closely punctate laterally and dorsally, slightly flattened (less so medially) and impunctate posteromedially. S1 strongly medially raised, not carinate. S8 truncate with stout apical spine, lateral margins straight, parallel apically and ending in a small lateral spine or tooth. Genitalia with well developed basal ring, basiparameres dorsoapically emarginate, and parameres apically truncate.

Etymology. The generic name is based on that of the orchid genus *Arthrochilus* which is pollinated by the type species.

KEY TO MALES OF *ARTHROTHYNNUS* GEN. NOV.

1. a Metasomal segments 2-3 red
..... *A. rufiabdominalis* sp. nov.
- b Metasomal segments black 2
2. a Legs black; head and mesosoma marked with pale creamy yellow; hind coxa with elongate yellow dorsal spot
..... *A. nigricrus* sp. nov.
- b Legs mostly orange; head and mesosoma marked with bright yellow; hind coxa either black or with extreme apex yellow 3
3. a Tegulae black *A. huntianus* sp. nov.
- b Tegulae orange or yellow 4
4. a Parameres (in profile) narrow (Fig. 2) [usually: anterior margin of pronotum narrowly yellow (discontinuous medially), posterior margin black at least medially; disc of mesoscutum black (rarely with small yellow spot); trochanters orange]
..... *A. angustus* sp. nov.
- b Parameres (in profile) broader (Figs 3,5) [usually: anterior and posterior margins of pronotum lined with yellow, and often confluent medially; disc of mesoscutum mostly yellow; trochanters black to orange] 5
5. a Parameres as in Fig. 3 [at least fore trochanters darker than femora, usually black] *A. latus* sp. nov.
- b Parameres as in Fig. 5 [fore trochanters and femora orange]
..... *A. queenslandensis* sp. nov.

Arthrothynnus huntianus sp. nov.

(Fig. 1)

Type material. HOLOTYPE male - NTM (I587): Mt Canobolas, New South Wales, attracted to *Chiloglottis trilabra* ex Batlow, 13 March 1993, CCB. PARATYPES - NEW SOUTH WALES: AM, BMNH (2 males): same data as holotype; BCRI (1 male): Cumberland Range, Adaminaby, 1988, G. Baker; NTM (1 male): Batlow Lookout Reserve, roosting on grass stem, late afternoon, 9 March 1988, CCB; AM, NTM (2 males): 1 km W of Batlow, attracted to *Arthrochilus huntianus* ex Batlow, 15 February 1989, CCB; AM, NTM (2 males): Blackbutt Mt, Sunny Corner State Forest, E of Bathurst, resting on grass and ferns, 6 March 1988, CCB; NTM (1 male): Kelly's Falls E of Helensburg, 11 October 1992, G. Brown and M. Terras; AM, ANIC, BCRI, NTM (4 males): Mt Canobolas, attracted to *Arthrochilus huntianus* ex 7km SSE of Mt Werong, 10 January 1988, CCB; AM, NTM (2 males): Towac entrance Rd, Mt Canobolas, swarming on grass tussock, 19 February 1989, CCB; AM, NTM (2 males): Mt Canobolas, attracted to *Chiloglottis trilabra* ex shale/sandstone Mt Werong, 3 March 1989, CCB; AM, ANIC, NTM (4 males): Mt Werong, attracted to *Arthrochilus huntianus*, 9 January 1988, CCB; NTM (1 male): 6 km E of Mt Werong, attracted to *Chiloglottis trilabra*, 5 March 1989, CCB; ANIC (1 male): Thredbo R.,

Mt Kosciusko, 3000 ft (914 m), 14 December 1931, R.L. Tonnoir; AM (1 male): 15 km SW of Nowra, 17 May 1982, G.J. and A. Holloway; AM, ANIC, BMNH, NTM (4 males): Rockley Mt, attracted to *Arthrochilus huntianus* ex 7 km SSE of Mt Werong, 9 January 1988, CCB; ANIC, BCRI, MV, NTM, QM (5 males): Oakey Ck, N Mullion Ra., attracted to *Arthrochilus huntianus* ex 7 km SSE of Mt Werong, 10 January 1988, CCB; AM, NTM (2 males): Vittoria, attracted to *Arthrochilus huntianus* ex 7 km SSE of Mt Werong, 9 January 1988, CCB; AUSTRALIAN CAPITAL TERRITORY: ANIC (1 male): Mt Gingera, 24.ii.1959, E.F. Riek; ANIC (1 male): Blundell's Camp, 4.i.1930, L. Graham; VICTORIA: ANIC (1 male): Grampians, attracted to *Arthrochilus huntianus*, 14 December 1977, W.P. Stoutamire; WPS (1 male): Portland, attracted to *Arthrochilus huntianus*, 13 December 1988, W.P. Stoutamire.

Description. Body length 7-10 mm; fore wing 6-8.5 mm; hind wing 4-6.5 mm. Clypeus closely and finely punctate. Frons rugosely punctate. Vertex closely punctate. Genae closely to rugosely punctate. Pronotum punctate medially becoming closely punctate laterally. Mesoscutum closely to rugosely punctate. Mesoscutellum closely punctate. Metanotum punctate. Propodeum transversely multistriate becoming reticulate near anterior margin. Fore coxae flat, obliquely truncate on apicomedial half, apex of truncation with fringe of long setae, lateral margin carinate apically. Mesopleura closely punctate. T1 as long as wide, sparsely punctate. T2-3 closely punctate basally, sparsely punctate apically. T4-6 closely punctate. Sternites closely punctate. Parameres with apex narrowly truncate and dorsal margin notched (Fig. 1C, D).

Colour. Black; mandibles, margin of clypeus, spot above antennal insertion, anterior margin of pronotum (narrowly interrupted medially), posterior margin of pronotum near tegulae, metanotum, and margins of mesosternal lamellae, yellow; legs (except coxae, trochanters and outer surface of hind tibiae), orange; small spot behind eye, tarsi, and outer surface of hind tibiae, brown. Wings weakly infusate; veins dark brown. Setae white, pale yellow on frons and vertex.

Distribution. Coast, ranges and tablelands of central and southern New South Wales and Victoria.

Remarks. The yellow colouration may be absent on the clypeus (especially in smaller speci-

mens), mandibles, and pronotum. Rarely the mesoscutellum has a small yellow spot.

This species is the pollinator of *Arthrochilus huntianus*, but is also attracted as a minor responder to *Chiloglottis trilabra*. The normal pollinator of *C. trilabra* Fitzg. is *Neozeleboria proxima* (Turner) (C.C. Bower, pers. comm.).

Arthrochilus huntianus is also recorded from Tasmania (Jones 1988), and is the only orchid of that genus to occur there. Perhaps surprisingly, the only records of *Arthrothynnus* from that state are two specimens of *A. latus*. It is unknown if *Arthrothynnus huntianus* occurs, or if, in its absence, the orchid is pollinated by *A. latus*. The former would appear more likely as: (1) there are relatively few tephid records from Tasmania; and (2) whilst it is probably unlikely that thynnine-pollinated orchids to occur naturally outside the range of the wasp, the converse is not true, and *A. latus* could occur there without an orchid to pollinate.

The pollination of *Arthrochilus huntianus* has been described by Rotherhan (1967). Although he believed the pollinator to be a species of *Rhagigaster*, the wasp drawn by him clearly is not of this genus, and is almost certainly that of the species described here. I have been unable to locate any specimens collected by Rotherhan.

Etymology. The species name is derived from the specific name of the orchid which this wasp pollinates.

Arthrothynnus angustus sp. nov.

(Fig. 2)

Type material. HOLOTYPE male - NTM (1588): Wonboyn Lake, S of Eden, New South Wales, attracted to *Chiloglottis diphylla* ex Bilpin Res., 4 April 1994, CCB. PARATYPES - NEW SOUTH WALES: ANIC, BMNH (2 males): same data as holotype; AM (1 male): Burralow Swamp, Blue Mountains NP, 9 December 1986, G.A. Holloway; NTM (1 male): Hartley Pass, 5 km N of Mt Victoria, attracted to *Chiloglottis diphylla* ex Mt Murray E of Robertson, 27 February 1994, CCB; AM (1 male): Iluka Nature Res., Clarence R., 30 January 1983, D.K. McAlpine and K.C. Khoo; NTM (1 male): Gillard Bch, Mimosas Rocks NP, Tanja, attracted to *Chiloglottis diphylla* (large form) ex Bilpin Res., 3 March 1994, CCB; AM (1 male): Mt Keira, 23 February 1983, G.A. Holloway; AM (1 male): Nerong SF, 3 Decem-

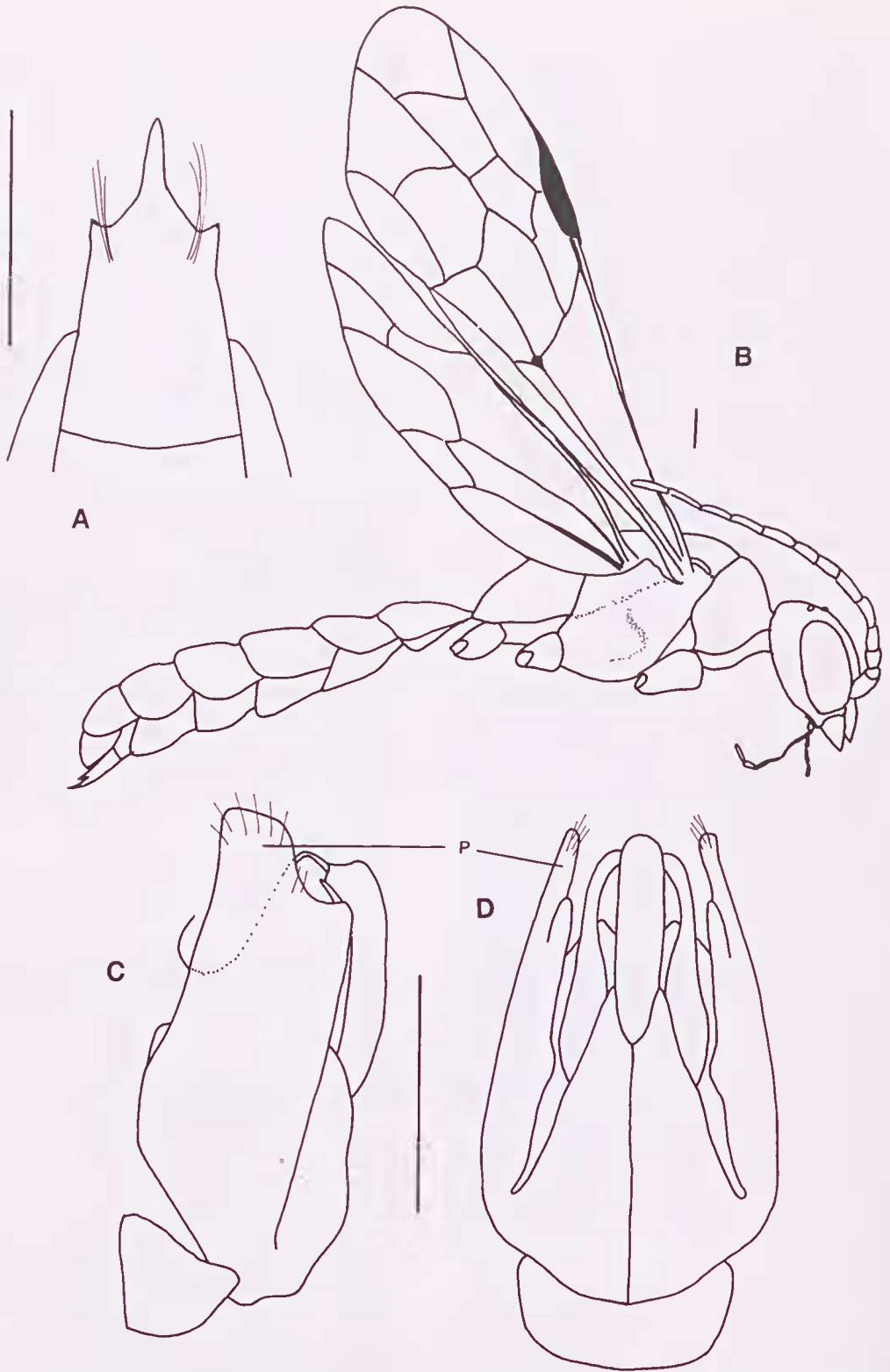


Fig. 1. *Arthrothynnus huntianus* sp. nov.: A, hypopygium; B, habitus; C, genitalia, lateral view; D, genitalia, dorsal view. Scale lines = 0.5 mm; p = parameres.

ber 1987, D.J. Scambler; AM (1 male): Royal NP, 7 February 1978, M.A. Schneider; AM (1 male): "Tuglo", 48 km N of Singleton, 17 December 1981, G.A. Holloway; NTM (2 male): Styx R. State Forest, possibly attracted to *Chiloglottis diphylla*, 24 February 1993, CCB; UQIC (1 male): Tooloom Plateau via Urbenville, 600-700 m, long grass, wet sclerophyll forest, 24 February 1974, I.D. Naumann; CCB collection (2 males): Zircon Ck, Mt Wilson, attracted to *Chiloglottis diphylla* ex Bilpin, 27 February 1993, CCB. QUEENSLAND: UQIC (1 male): Cunningham's Gap NP, 25 January 1966, T. Weir; UQIC (3 males): Upper Clayton Gully nr Cunningham's Gap, 400-600 m, 25 April 1974, I.D. Naumann; UQIC (2 males): Teviot Brook, nr Wilson's Peak, 153°31'E, 28°13'S, 17-18 October 1980, G. Daniels and M.A. Schneider; UQIC (1 male): Mt Glorious, 15 January 1963, T. Brooks; UQIC (1 male): Woodford, 26 February 1965, F.D. Page.

Description. Body length 9-10 mm; fore wing 7-8 mm; hind wing 5-5.5 mm. Clypeus closely and finely punctate. Frons rugosely punctate. Vertex closely and finely punctate. Genae rugosely and finely punctate. Pronotum closely to rugosely punctate. Mesocutum closely to rugosely punctate. Mesoscutum closely punctate. Metanotum punctate. Propodeum transversely multistriate becoming reticulate near anterior margin. Fore coxae flat, obliquely truncate on apicomedial third, apex of truncation with fringe of long setae, lateral margin not carinate. Mesopleura closely punctate becoming rugosely punctate dorsally. T1 as long as wide, sparsely

punctate. T2-5 closely and finely punctate becoming sparsely punctate apically. T6 closely and finely punctate. Sternites closely punctate. Parameres with apex narrowly truncate, dorsal margin not notched (Fig. 2A, B).

Colour. Black; clypeus, inner orbits of eye ventrally, spot above antennal insertion, anterior margin of pronotum (narrowly interrupted medially), posterior margin near tegulae, small spot on mesocutellum (often indistinct) and metanotum, yellow; mandibles, antennae, tegulae, and legs (except coxae), orange; small spot behind eye, brown. Wings weakly infuscate; veins dark brown to black becoming orange basally. Setae white.

Distribution. Coast and ranges of New South Wales and south-eastern Queensland.

Remarks. The flagellum varies from orange (especially ventrally) to black while the mesosternal lamellae may be testaceous, black, or margined with yellow.

This species is a pollinator of *Chiloglottis diphylla* R.Br. (C.C. Bower, pers. comm.), but although the orchid species and the wasp species occupy overlapping geographical ranges, all records are for translocated flowers.

Etymology. The species name is derived from the Latin and refers to the narrowness of the parameres of the male genitalia.

Arthrothynnus latus sp. nov.

(Fig. 3)

Type material. HOLOTYPE male - NTM (1589): "Kooroo", Mullion Ck, 21 km N of Orange, New South Wales, attracted to *Chiloglottis diphylla* ex Seven Mile Beach, 26 March 1994, CCB. PARATYPES - NEW SOUTH WALES: ANIC, BMNH (2 males): same data as holotype; NTM (1 male): Cathedral Rocks NP, attracted to *Chiloglottis diphylla* ex Styx R., 28 March 1993, CCB; NTM (1 male): Cathedral Rocks NP, attracted to *Chiloglottis pluricallata* ex Mt Carson, Barrington Tops, 31 December 1993, CCB; AM (1 male): Mt Kaputar, c.1370 m, 14 January 1978, G. Daniels; AM, ANIC, BCRI, NTM (9 males): Mullion Ck, attracted to *Chiloglottis diphylla* ex Bilpin, 14 March 1993, CCB; AM, ANIC, BCRI, NTM (6 males): Mullion Ck, attracted to *Chiloglottis diphylla* ex Styx R. NP, 3 April 1993, CCB; AM, ANIC, BCRI, QM, NTM (6 males): "Kooroo", Mullion Ck, 21 km N of Orange, attracted to *Chiloglottis diphylla* ex Mt Murray, 20 February 1994, CCB; AM, ANIC, NTM,

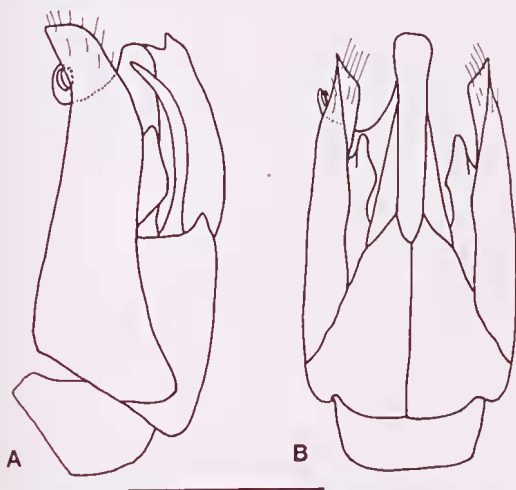


Fig. 2. *Arthrothynnus angustus* sp. nov.: A, genitalia, lateral view; B, genitalia, dorsal view. Scale lines = 0.5 mm.

SAM (4 males): "Kooroo", Mullion Ck, 21 km N of Orange, attracted to *Chiloglottis anaticeps* ex Armidale-Grafton rd, 4.5 km E of Pt Look-out turnoff, 1 March 1994, CCB; NTM (1 male): "Kooroo", Mullion Ck, 21 km N of Orange, attracted to *Chiloglottis anaticeps* ex Grass Tree Picnic Area, Werrikimbe NP, NW of Wauchope, 1 March 1994, CCB; NTM (1 male): "Kooroo", Mullion Ck, 21 km N of Orange, attracted to *Chiloglottis seminuda* ex Fitzroy Falls W of Roberston, 1 March 1994, CCB; AM, ANIC, MV, NTM (7 males): "Kooroo", Mullion Ck, 21 km N of Orange, attracted to *Chiloglottis diphylla* ex Bilpin Res., 26 March 1994, CCB; AM, ANIC, BCRI, BMNH, MV, NTM, QM, SAM (33 males): "Kooroo", Mullion Ck, 21 km N of Orange, attracted to *Chiloglottis diphylla* ex Bilpin Res., 1 March 1995, CCB; AM, ANIC, BCRI, BMNH, NTM (7 males): Serpentine Nature Reserve, attracted to *Chiloglottis diphylla* ex Styx R., 28 March 1993, CCB; CCB collection (1 male): "Kooroo", Mullion Ck, 23 km N of Orange, 26 March 1995, CCB; NTM (1 male): Serpentine Nature Reserve, attracted *Chiloglottis pluricallata* ex Mt Carson, Barrington Tops, 31 December 1993, CCB; AM, ANIC, NTM (3 males): Serpentine Nature Reserve, attracted to *Chiloglottis pluricallata* ex Barrington Tops, 1 January 1995, CCB; BCRI (1 male): "Daisy Hill", 11.5 km NE of Wollomombi, 152°10'E, 30°27'S, 29 July 1993 (R1), A. Campbell & C. Haywood; NTM (1 male): "Fairburn", 13.6 km NE of Wollomombi, 152°10'E, 30°27'S, 2 December 1993 (M29), A. Campbell and C. Haywood. TASMANIA: UQIC (1 male): Murdunna, Forestier Peninsula, on *Bursaria spinosa* 4 January 1969, E.M. Exley; UQIC (1 male): Port Arthur, 4 January 1969, on *Leptospermum* sp., E.M. Exley.

Description. Body length 6-13 mm; for a wing 4.5-9 mm; hind wing 3.5-7 mm. Clypeus closely and finely punctate. Frons rugosely punctate. Vertex closely and finely punctate. Genae rugosely and finely punctate. Pronotum closely punctate. Mesoscutum closely to rugosely punctate. Mesoscutellum closely punctate. Metanotum punctate. Propodeum transversely multistriate becoming reticulate near anterior margin. Fore coxae flat, obliquely truncate on apicomedial third, apex of truncation with fringe of long setae, lateral margin not carinate. Mesopleura closely punctate becoming rugosely punctate dorsally. T1 as long as wide, sparsely punctate. T2-6 closely and finely punctate.

Sternites closely punctate. Parameres with apex broadly truncate, dorsal margin not notched (Fig. 3A, B).

Colour. Black; mandible, clypeus, inner orbits of eye ventrally, spot above antennal insertion, anterior and posterior margins (often confluent medially) of pronotum, large spot on mesoscutellum, and metanotum, yellow; antennae, tegulae, and legs (except coxae and trochanters), orange; small spot behind eye brown. Wings hyaline; veins brown to black becoming orange basally. Setae white, pale yellow on frons and vertex.

Distribution. Ranges and tablelands of New South Wales, with two records from Tasmania.

Remarks. The yellow colouration may be reduced on the clypeus (to the margins in smaller specimens) and mesoscutellum, and interrupted medially on the pronotum. The reduction in colouration on the mesoscutellum is particularly noticeable on northern specimens (Cathedral Rocks, Serpentine River and Wollomombi), while a single specimen from Mullion Ck (14 March 1993) has small lateral yellow marks on T2-4. Orange colouration may be absent or reduced on the antennae and trochanters (especially fore trochanters which are darker than the femora). Mesosternal lamellae may be testaceous, black, or margined with yellow.

This species is the pollinator of *Chiloglottis diphylla* and a minor responder to *C. anaticeps*, *C. pluricallata* and *C. seminuda*. Although all records for *C. diphylla* are for translocated flow-

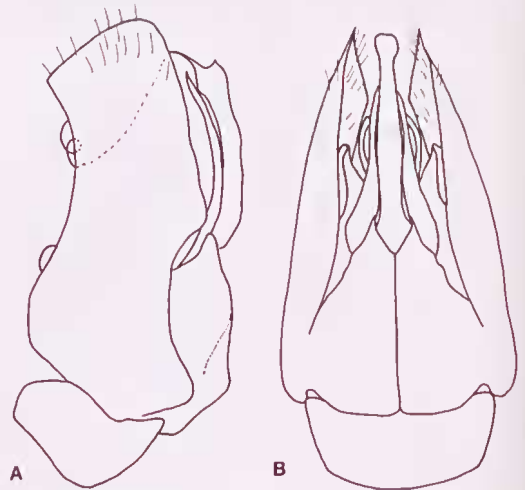


Fig. 3. *Arthrothynnus latus* sp. nov.: A, genitalia, lateral view; B, genitalia, dorsal view. Scale lines = 0.5 mm.

ers, the wasp and orchid have overlapping distributions (C.C. Bower, pers. comm.).

Etymology. The species name is derived from the Latin and refers to the broadness of the parameres of the male genitalia.

Arthrothynnus nigricrus sp. nov.
(Fig. 4)

Type material. HOLOTYPE male - NTM (1590): Cairncross SF, 10 km NW of Port Macquarie, New South Wales, attracted to *Chiloglottis pluricallata* ex Mt Carson, Barrington Tops, 29 December 1993, CCB. PARATYPE - NTM (1 male): same data as holotype.

Description. Body length 9 mm; fore wing 7 mm; hind wing 5 mm. Clypeus closely and finely punctate. Frons rugosely punctate. Vertex and genae closely and finely punctate. Pronotum closely to rugosely punctate. Mesoscutum rugosely punctate. Mesoscutellum closely punctate. Metanotum punctate. Propodeum transversely multistriate becoming reticulate anteriorly. Fore coxae weakly convex becoming shallowly concave apically, without fringe of setae, lateral margin not carinate. Mesopleura closely punctate becoming rugosely punctate dorsally. T1 longer than wide, sparsely punctate. T2-5 sparsely punctate. T6 sparsely punctate becoming closely punctate posteriorly. Sternites closely punctate. Parameres with apex broadly truncate, dorsal margin notched (Fig. 4A, B).

Colour. Black; mandibles, margin of clypeus, inner orbits of eye ventrally, spot above antennal insertion, anterior margin of pronotum (narrowly interrupted medially), posterior margin

near tegulae, spot below fore wing, metanotum, margins of mesosternal lamellae, and elongate dorsal spot on hind coxae, pale yellow; small spot behind eye, fore tarsi, and inner surface of fore tibia, brown. Wings hyaline; veins dark brown to black. Setae white.

Distribution. Known only from the north coast of New South Wales.

Remarks. This species is an allopatric minor responder to *Chiloglottis pluricallata*.

Etymology. The species name is derived from the Latin and refers to the black legs.

Arthrothynnus queenslandensis sp. nov.
(Fig. 5)

Type material. HOLOTYPE male - QM: 7 km NE of Tolga, Queensland, light trap, April 1987, Storey and De Faveri. PARATYPES - QUEENSLAND: UQIC (1 male): Brisbane, 7 October 1979, H.E. and M.A. Evans; UQIC (1 male): Carnarvon National Park, 8-10 December 1979, M.A. Schneider and G. Daniels; NTM (1 male): Petrie, 4 December 1962, I.C. Yeo.

Description. Body length 9 mm; fore wing 7 mm; hind wing 5 mm. Clypeus closely and finely punctate. Frons rugosely punctate. Vertex closely and finely punctate. Genae rugosely and finely punctate. Pronotum, mesoscutum and mesoscutellum rugosely punctate. Metanotum closely punctate. Propodeum rugosely punctate becoming reticulate near anterior margin. Fore coxae flat, obliquely truncate on apicomedial third, apex of truncation with fringe of long setae, lateral margin not carinate. Mesopleura rugosely punctate. T1 as long as wide. Tergites

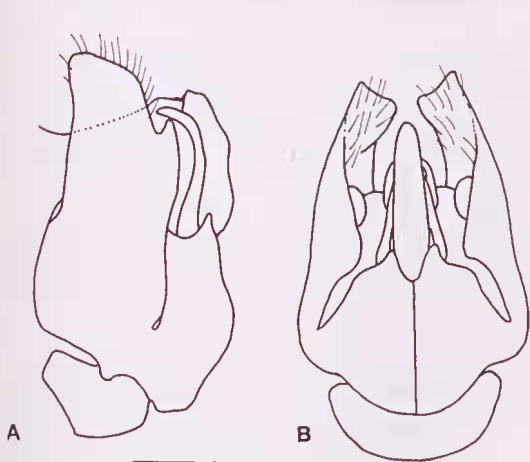


Fig. 4. *Arthrothynnus nigricrus* sp. nov.: A, genitalia, lateral view; B, genitalia, dorsal view. Scale lines = 0.5 mm.

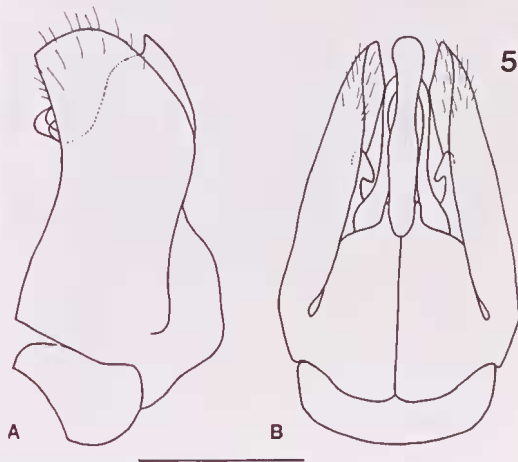


Fig. 5. *Arthrothynnus queenslandensis* sp. nov.: A, genitalia, lateral view; B, genitalia, dorsal view. scale lines = 0.5 mm.

and sternites closely punctate. Parameres with apex truncate, dorsal margin not notched (Fig. 5A, B).

Colour. Black; mandible, clypeus, inner orbits of eye ventrally, spot above antennal insertion, anterior and posterior margins (confluent medially) of pronotum, large spot on mesoscutellum, and metanotum, lateral spot on propodeum, margins of mesosternal lamellae and extreme apex of mid and hind coxa, yellow; antennae, tegulae, and legs (except coxae), orange; small spot behind eye, brown. Wings hyaline; veins, orange. Setae white, pale yellow on frons and vertex.

Distribution. Northern to south-eastern Queensland.

Remarks. Southern Queensland specimens resemble *A. angustus* in colour, with yellow reduced or absent on, much of the clypeus, posterior margin of the pronotum, mesoscutellum, and propodeum.

This may be the pollinator of *Arthrochilus dockrillii* Lavarack which occurs in north-eastern Queensland and New Guinea (Jones 1988).

Etymology. The species name is derived from the general area of the type locality.

Arthrothynnus rufiabdominalis sp. nov.

(Figs 6, 7)

Type material. HOLOTYPE male - NTM, (1592): Wide Bay area, Queensland, pollinating *Arthrochilus irritabilis*, 27 November 1995, A. Logan. PARATYPES - QUEENSLAND: AM, ANIC, BMNH, MV, NTM, QM (9 males): same data as holotype; ANIC (1 male): Bundaberg, August - September 1971, H. Frauca; QDPI (1 male,) Tolga, at light trap, 21 November 1986, J. D. Brown; UQIC (2 males): Milmerran, on *Eucalyptus*, 6 November 1981, E. M. Exley and J. King; BMNH, NTM (4 males): Wide Bay area, pollinating *Arthrochilus irritabilis*, 17 November 1995, A. Logan.

Description. Body length 9-11 mm; fore wing 5-7 mm; hind wing 3-5 mm. Clypeus closely and finely punctate. Frons rugosely punctate. Vertex closely punctate. Genae, pronotum and mesoscutum closely to rugosely punctate. Mesoscutellum rugosely punctate. Metanotum punctate. Propodeum transversely multistriate becoming reticulate near anterior margin. Fore coxae weakly convex becoming flat on apical half, flat area densely setose without distinct fringe, lateral margin not carinate. Mesopleura closely to rugosely punctate. T1 as long as wide,

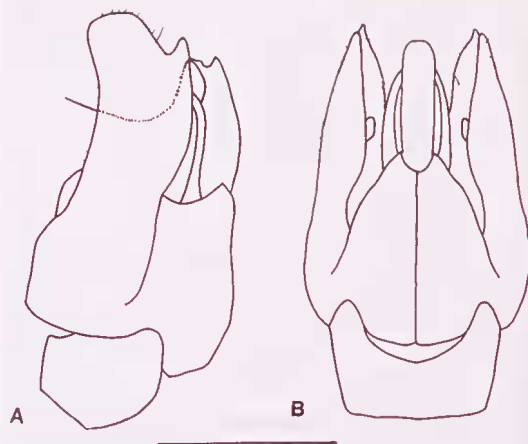


Fig. 6. *Arthrothynnus rufiabdominalis* sp. nov.: A, genitalia, lateral view; B, genitalia, dorsal view. Sclae lines = 0.5 mm.

sparingly punctate. T2-6 closely punctate basally, sparsely punctate apically. Sternites closely and shallowly punctate. Parameres with apex narrowly truncate and dorsal margin notched (Fig. 6A, B).

Colour. Black; mandibles; clypeus (except medially), spot above antennal insertion, anterior margin of pronotum (narrowly interrupted medially), posterior margin of pronotum (interrupted medially), sagittal line on mesoscutellum, metanotum, and margins of mesosternal lamellae, dorsal margin of hind coxae, yellow; tegulae and legs (except coxae, trochanters and base of femora), orange; small spot behind eye, tarsi, and outer surface of tibiae, brown; T2-4, S2-4 and apex of T1, red. Wings hyaline; veins brown. Setae white.

Distribution. Known only from north and south-eastern Queensland.

Remarks. Yellow colouration may be more extensive on the pronotum while the red colouration may be absent from T1, T4 and S4.

This species is the pollinator of *Arthrochilus irritabilis* F. Mueller which ranges from New Guinea to north-eastern Queensland and south to the central coast of New South Wales (Jones, 1988). The wasp, although only recorded from Queensland, probably has a distribution similar to that of the orchid.

The thynnine fauna of New Guinea is poorly known, with most described species being large and conspicuous. It is unknown if this small and relatively inconspicuous species occurs, but it, or a closely related wasp species would probably be necessary for the occurrence of the orchid in New Guinea.



Fig. 7. *Arthrothynnus rufiabdominalis* sp. nov. pollinating *Arthrochilus irritibilis* orchids.

Etymology. The species name is derived from the Latin and refers to the colour of the metasoma (abdomen).

DISCUSSION

The six species described here are similar in appearance. They exhibit similar colour patterns and lack morphological characters of diagnostic value other than distinctive male genitalia.

The colouration of *A. nigricrus* differs from all other species of *Arthrothynnus* in that the legs are black, and pale markings are a pale creamy yellow, rather than orange and brighter yellow respectively. This species is probably most closely related to *A. huntianus* as both species have the dorsal margin of the parameres characteristically lobed. Both species also have the tegulae black rather than orange or yellow as in all other species.

The colouration of *A. rufiabdominalis* is also distinctive in that metasomal segments 2-4 are red. The dorsal margin of the parameres are also notched, but they are long and narrow, and resemble those of *A. angustus* which have been widened basally and notched dorsally.

The colour pattern of *A. queenslandensis* is variable, with the holotype from north Queensland resembling *A. latus*, while the three specimens from southern Queensland are similar to *A. angustus*. The genitalia of *A. queenslandensis* and *A. latus* are similar in that the parameres are relatively broad, as they are in *A. nigricrus* and *A. huntianus*, but not dorsally lobed as in the latter two species.

A. angustus has long narrow parameres, and is probably most closely related to *A. rufiabdominalis*.

Arthrothynnus is grouped with the genera *Encopothynnus* Turner, *Iswaroides* Ashmead, *Acanthothynnus* Turner, *Dorathynnus* Turner, *Aspidothynnus* Turner, *Gymnothynnus* Turner, *Epactiothynnus* Turner and *Tmesothynnus* Turner. These genera are distinguished from all other Australian Thynninae by the combination of: a relative short weakly protruding hypopygium that is not broadened and lobed or spined at the base, and which is armed apically with a narrow or broader testaceous spine (with or without small lateral spines); the epipygium weakly flattened apically with the apical margin carinate; the metasomal segments constricted; and the basiparameres angled and separated from the basal ring ventrobasally. *Arthrothynnus* is distinguished from these genera by the clypeus which is narrowly truncate and weakly medially raised, the antennal prominence which is above the plane of the clypeus, and the truncated parameres. It is closest to *Tmesothynnus* in that the hypopygium is similarly shaped, and the metasoma is usually black.

The remaining genera of this group are distinguished by the following characters: spines on the tergum in *Encopothynnus*; spines on the sternum in *Iswaroides*, *Acanthothynnus* and *Dorathynnus*; an elongate-fusiform metasoma, and a swollen, produced and broadly apically truncate clypeus in *Aspidothynnus*; a short fusiform metasoma, and testaceous and often flattened hypopygial spines in *Gymnothynnus*; and a triangular hypopygium in *Epactiothynnus*.

Arthrothynnus is superficially similar to *Neozeleboria* in that the antennal prominence is above the plane of the clypeus, but the latter has the apical maxillary palp segments lengthened, the hypopygium triangular, rounded or subparallel and truncate, but with a single apical spine without lateral spines or teeth, and does not have the metasomal segments constricted.

The genus is only recorded from eastern Australia, with most specimens having been collected by C.C. Bower in eastern New South Wales, although *A. queenslandensis* and *A. rufiabdominalis* occur in both northern and south-eastern Queensland. There are two records of *A. huntianus* from Victoria, and two records of *A. latus* from Tasmania. All species except *A. queenslandensis* are recorded as pollinators of orchids of the genera *Arthrochilus* and *Chiloglottis* which occur in eastern Australia. A further two species of *Arthrochilus* occur in the Northern Territory, but their pollinators are as yet unknown.

Nothing is known about the biology of this genus other than that males are orchid pollinators.

ACKNOWLEDGMENTS

The majority of material has been provided by orchid enthusiasts, particularly Dr Col. Bower, to whom I am indebted. This work was also partially funded by the Australian Orchid Foundation. The operation of the Malaise traps at Wollomombi was part of a co-operative research project with Gus Campbell, and was funded by RIRDC. The photograph of *Arthrothynnus rufiabdominalis* was brought to my attention by Alan Logan and was taken from a colour slide by E.C.J. (Ted) Smith. It forms part of the A.N.O.S. Wide Bay Group's terrestrial slide library, and is reproduced with permission of the Group. Alan Logan also collected most of the type specimens of this species.

REFERENCES

- Adams, P.B. and Lawson, S.D. 1993. Pollination in Australian orchids: a critical assessment of the literature 1882-1992. *Australian Journal of Botany* 41: 553-75.
- Armstrong, J.J. 1979. Biotic pollination mechanisms in the Australian flora - a review. *New Zealand Journal of Botany* 17: 467-508.
- Brown, G.R. 1989. The Australian genus *Encopothynnus* Turner (Hymenoptera: Tiphidae). *Journal of the Australian Entomological Society* 28: 255-266.
- Brown, G.R. 1996. *Chilothynnus*, a new genus of Australian Thynninae (Hymenoptera: Tiphidae) associated with orchids. *The Beagle, Records of the Museums and Art Galleries of the Northern Territory* 13: 61-72.
- Bower, C.C. 1992. The use of pollinators in the taxonomy of sexually deceptive orchids in the Subtribe Caladeniinae (Orchidaceae). *The Orchadian* 10(9): 331-338.
- Jones, D.L. 1988. *Native orchids of Australia*. Reed Books: Frenchs Forest, Australia.
- Naumann, I.D. 1991. Hymenoptera (wasps, bees, ants, sawflies). In: Naumann, I.D. (ed.) *The insects of Australia. A textbook for students and research workers*. Pp 916-1000. Melbourne University Press: Carlton, Victoria.
- Rotherhan, E.R. 1967. Pollination of *Spiculea huntiana* (F. Muell.) Schltr. *The Orchadian*. 2(9): 120-121.
- Snodgrass, R.E. 1941. The male genitalia of Hymenoptera. *Smithsonian Miscellaneous Collections* 99: 1-86.

Accepted 14 February, 1996